

2009 Petrel Bank Red King Crab Pot Survey: Results for Red King Crab

by

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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| Weights and measures (metric) | | General | | Measures (fisheries) | |
|---|--------------------|--|-------------------------------|---|-------------------------|
| centimeter | cm | Alaska Administrative Code | | fork length | FL |
| deciliter | dL | | AAC | mideye to fork | MEF |
| gram | g | all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. | mideye to tail fork | METF |
| hectare | ha | | | standard length | SL |
| kilogram | kg | | | total length | TL |
| kilometer | km | all commonly accepted | | | |
| liter | L | professional titles | e.g., Dr., Ph.D., R.N., etc. | Mathematics, statistics | |
| meter | m | | | <i>all standard mathematical signs, symbols and abbreviations</i> | |
| milliliter | mL | at | @ | | |
| millimeter | mm | compass directions: | | | |
| | | east | E | alternate hypothesis | H _A |
| Weights and measures (English) | | north | N | base of natural logarithm | <i>e</i> |
| cubic feet per second | ft ³ /s | south | S | catch per unit effort | CPUE |
| foot | ft | west | W | coefficient of variation | CV |
| gallon | gal | copyright | © | common test statistics | (F, t, χ^2 , etc.) |
| inch | in | corporate suffixes: | | confidence interval | CI |
| mile | mi | Company | Co. | correlation coefficient (multiple) | R |
| nautical mile | nmi | Corporation | Corp. | | |
| ounce | oz | Incorporated | Inc. | correlation coefficient (simple) | r |
| pound | lb | Limited | Ltd. | | |
| quart | qt | District of Columbia | D.C. | covariance | cov |
| yard | yd | et alii (and others) | et al. | degree (angular) | ° |
| | | et cetera (and so forth) | etc. | degrees of freedom | df |
| Time and temperature | | exempli gratia | | expected value | <i>E</i> |
| day | d | (for example) | e.g. | greater than | > |
| degrees Celsius | °C | Federal Information Code | FIC | greater than or equal to | ≥ |
| degrees Fahrenheit | °F | | | harvest per unit effort | HPUE |
| degrees kelvin | K | id est (that is) | i.e. | less than | < |
| hour | h | latitude or longitude | lat. or long. | less than or equal to | ≤ |
| minute | min | monetary symbols | | logarithm (natural) | ln |
| second | s | (U.S.) | \$, ¢ | logarithm (base 10) | log |
| | | months (tables and figures): first three letters | Jan.,...,Dec | logarithm (specify base) | log ₂ , etc. |
| Physics and chemistry | | | | minute (angular) | ' |
| all atomic symbols | | | | not significant | NS |
| alternating current | AC | registered trademark | ® | null hypothesis | H ₀ |
| ampere | A | trademark | ™ | percent | % |
| calorie | cal | United States | | probability | P |
| direct current | DC | (adjective) | U.S. | probability of a type I error (rejection of the null hypothesis when true) | α |
| hertz | Hz | United States of America (noun) | USA | | |
| horsepower | hp | | | probability of a type II error (acceptance of the null hypothesis when false) | β |
| hydrogen ion activity (negative log of) | pH | U.S.C. | United States Code | | " |
| parts per million | ppm | U.S. state | use two-letter abbreviations | second (angular) | |
| parts per thousand | ppt, ‰ | | (e.g., AK, WA) | standard deviation | SD |
| | | | | standard error | SE |
| volts | V | | | variance | |
| watts | W | | | population sample | Var var |

REGIONAL INFORMATION REPORT 4K10-06

**2009 PETREL BANK RED KING CRAB POT SURVEY: RESULTS FOR
RED KING CRAB**

by

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ABSTRACT

This report documents the methods and results of the 2009 Petrel Bank pot (trap) survey on the distribution and relative abundance of red king crabs *Paralithodes camtschaticus* in the central Aleutian Islands waters of the Petrel Bank area. The primary purposes of this survey were to provide information needed by fishery managers to consider a fishery opening in the 2010/11 season and to address the need discussed by the North Pacific Fishery Management Council Crab Plan Team (CPT) during their September 2008 meeting for stock assessment data from the Adak red king crab stock. The Alaska Department of Fish and Game (ADF&G) conducted the survey aboard the chartered *F/V Arctic Fury*, a 44.2-m commercial crab-pot-fishing vessel from November 6 to December 5, 2009. Results on the catch and sex-size composition of only the red king crabs encountered during the survey are presented. Most red king crabs captured during the survey occurred in a limited portion of the surveyed area and were predominately larger, matured-sized crabs. Size distribution of captured males provided no expectations for near-term recruitment of legal males. In comparison to results from the same stations fished during the 2006 ADF&G Petrel Bank pot survey, the catch of red king crabs during the 2009 survey occurred in a more limited area and the catch of legal males was lower.

Keywords: Red king crab, *Paralithodes camtschaticus*, Petrel Bank, Aleutian Islands, pot survey, trap survey distribution, relative abundance.

INTRODUCTION

The red king crab *Paralithodes camtschaticus* fishery in the Aleutian Islands Area (Registration Area O) began in 1961 and attained its maximum season harvest of 38.7-million pounds in the 1966/67 season (Bush et al. 2005). Although the Aleutian Islands Area has been defined since 1996 as encompassing the waters of the Territorial Sea and Exclusive Economic Zone about the Aleutian Islands west of 164° 44' W longitude, through the history of the fishery the current Aleutian Islands Area has been variously subdivided into two or three separate registration areas (Schmidt 1973, Griffin and Dunaway 1985, ADF&G 1973, Tate and Nelson 1978). Prior to the establishment of the current single registration area, the area was subdivided into the Adak Registration Area (the area west of 171° W longitude) and the Dutch Harbor Area (the area east of 171° W longitude). During 1961–1984 the two registration areas were separated at 172° W longitude and during 1967–1977 the waters east of Petrel Bank and westward were separated from the Adak Area to create the Western Aleutians Area. Peak red king crab harvest in the Dutch Harbor Area was 32.9-million pounds and occurred in the 1966/67 season. By the 1982/83 season, the harvest from the Dutch Harbor Area had declined to 430-thousand pounds and the area east of 171° W longitude has remained closed to commercial fishing for red king crabs since the closure of the 1982/83 season. Peak red king crab harvest in the Adak Area was 21.2-million pounds and occurred in the 1964/65 season. Harvests from the Adak Area declined to 39-thousand pounds during the 1995/96 season and the Aleutian Islands Area was closed to all commercial fishing for red king crabs during the 1996/97 and 1997/98 seasons. Prior to the closure in 1996/97, the western Aleutian Islands harvest statistics reflected a compression in the area supporting fishery harvests (Bowers et al. 2002). Harvests from the Attu Island area declined in the early to mid-1980s, followed by declines in the harvest from the Atka-Amlia Islands area in the late 1980s. During the 1990/91 through the 1995/96 seasons, the geographic area supporting fishery harvests was essentially reduced to the waters between 179° W longitude and 179° E longitude and north of 51° 45' N latitude (the Petrel Bank area; Figure 1). However, by the 1995/96 season fishery performance in the Petrel Bank area had also declined and observer collected data indicated recruitment failure in the area. Since the 2000/01 season, commercial harvest of red king crabs in the Aleutian Islands Area has occurred only within the Petrel bank area and the Aleutian Islands Area has been closed to commercial fishing since the end of the 2003/04 season (Bowers et al. 2008).

Due to the lack of a stock assessment survey program for the red king crabs of the western Aleutian Islands, the Alaska Department of Fish and Game (ADF&G) worked cooperatively with industry during 1996–2001 to gain information regarding red king crabs in the Petrel Bank area (see Gish 2007 and references therein for a more complete review of ADF&G-industry cooperative work during 1996–2001). During the closed red king crab fishery seasons of 1996/97 and 1997/98, a vessel commercially fishing for golden king crabs *Lithodes aequispinus* was allowed to fish a limited number of single pots to capture, but not retain, red king crabs and an observer on the vessel enumerated, tagged, and collected biological data from all red king crabs captured by the single pots, as well as all those incidentally captured during directed golden king crab fishing. That effort provided no data supporting the opening of a red king crab fishery in the Petrel Bank area and the Petrel Bank area remained closed to commercial red king crab fishing during the 1998/99 season, while areas outside of the Petrel Bank area were opened for limited exploratory fishing. The results of that exploratory fishing provided no support for opening any area within the Aleutian Islands Area to commercial red king crab fishing in the 1999/00 season. During January–February 2001 and November 2001 ADF&G utilized the commercial fleet to conduct pot surveys of the Petrel Bank area. The two ADF&G-industry surveys were conducted as fisheries under provisions of a commissioner’s permit that specified the areas to be fished (stations), soak times of pots, and the number of pots fished per station and allowed fishers to retain and sell all legal male red king crabs captured during the survey. In both of the ADF&G-industry surveys conducted during 2001 relatively few sublegal male and female red king crabs were captured, but the catch per pot lift (CPUE) of legal male red king crabs was high (22.6 crabs per pot lift in January–February 2001 and 32.2 crabs per pot lift in November 2001).

Given the high CPUE of legal males during the two ADF&G-industry surveys of 2001, a limited commercial fishery on the Petrel Bank was re-opened during the 2002/03 and 2003/04 seasons with a 500,000-pound guideline harvest level (GHL) and a minimum threshold CPUE of 10 legal male crabs per pot lift (Bush et al. 2005). The harvest during the 2002/03 season was 506,642 pounds with a CPUE of 18 legal males per pot lift and 479,113 pounds were harvested during the 2003/04 season with a CPUE of 10 legal males per pot lift. Data collected during the two ADF&G-industry surveys in 2001 (Bowers et al. 2002; Neufeld and Barnard 2003) and during the subsequent commercial fisheries of 2002/03 season (Barnard and Burt 2004) and the 2003/04 season (Burt and Barnard 2005) showed that primarily post-recruit crabs supported the Petrel Bank red king crab fishery. Fishery performance and observer collected data from the 2002/03 and 2003/04 commercial fisheries indicated that the harvests were largely supported by a single, aging cohort of crabs and that there was little possibility of new recruitment to the legal size class for the 2004/05 or 2005/06 seasons (Bush et al. 2005). The fishery was closed for the 2004/05 season due to evidence of stock decline and lack of recruitment (Granath 2004) and has remained closed through the 2009/10 season.

ADF&G performed a systematic pot survey for red king crabs in the Petrel Bank area for the first time during November 2006 to evaluate if adequate recruitment to the legal size class had occurred since the close of the 2003/04 season and to provide information needed for considering an opening of the Petrel Bank red king crab fishery during the 2007/08 season (Gish 2007). Results of the 2006 pot survey showed little recruitment to the stock, a more restricted geographical distribution, and a low relative abundance of legal male red king crabs on Petrel Bank compared to the 2001 ADF&G-industry surveys (Gish 2007). Therefore, the fishery remained closed for the 2007/08 season (Bowers et al. 2008). An ADF&G pot survey was

planned for 2007, but was it cancelled when no responsive bids were received from industry for the vessel charter.

To provide information needed by fishery managers to consider a fishery opening in the 2010/11 season and to address the need discussed by the Crab Plan Team (CPT) during their September 2008 meeting for stock assessment data on red king crabs in the western Aleutian Islands (http://www.fakr.noaa.gov/npfmc/membership/plan_teams/CPT/908CPTminutes.pdf), the Petrel Bank area was surveyed again by ADF&G in November of 2009. This report documents the methods and results of the November 2009 ADF&G Petrel Bank red king crab pot survey. Results on the catch and sex-size composition of only the red king crabs encountered during the survey are presented and are compared to the results from the November 2006 ADF&G pot survey. Results on the catch of other species encountered during the survey will be presented in a forthcoming ADF&G Fishery Management Report.

Note that, in accordance with AS 16.05.815 (c), data on catch by location obtained during the November 2009 survey or associated fishing cannot be released until the close of the fishing season for which the survey was conducted, the 2010/11 season for red king crab in the Petrel Bank area. Hence data on catch by location during the November 2009 survey is not presented in this report but will be presented in the forthcoming ADF&G Fishery Management Report.

METHODS

Survey Area and Design

The 2009 survey was intended to resample and expand the area sampled by the November 2006 ADF&G survey (Gish 2007). Both the 2006 and 2009 ADF&G surveys were, in turn, designed to resample and expand the area sampled by the November 2001 ADF&G-industry survey for red king crabs (Bowers et al. 2002; Figure 2) and to sample from the principle areas fished during the 2002/03 and 2003/04 commercial Petrel Bank red king crab fisheries (Appendix B8 in Barnard and Burt 2004; Appendix B8 in Burt and Barnard 2005). The survey area encompassed Petrel Bank and waters adjacent to Semisopochnoi Island and was bounded by 51° 50' N latitude to the south, 52° 47' N latitude to the north, 179° 18' W longitude to the east, and 179° 46' E longitude to the west. The survey area encompassed the area that accounted for 77% to 95% of the total annual Adak red king crab harvests for the 1990/91 through 1995/96 seasons (Gish 1997; Griffin and Ward 1992, 1994; Morrison and Gish 1994, 1996, 1997; Figure 1).

Prior to the survey, a survey station grid in which station centers were spaced by 2.50' latitude (2.50 nmi, or 4.6 km) north-to-south and by 3.75' longitude (approximately 2.29 nmi, or 4.2 km) west-to-east was established within the survey area defined for the November 2001 ADF&G-industry survey (i.e., the Petrel Bank area within the 100-fathom, or 183-m, depth contour and Petrel Spur south of 52° 38' N latitude; Bowers et al. 2002; Figure 2). The resulting grid of 119 stations contained the stations with highest priority for sampling during this survey and provided for four or more survey stations within the majority of the 28 station areas defined for the November 2001 ADF&G-industry survey. The survey station grid was then extended with the same spacing of station centers into the area of Petrel Spur to depths of 150 fathoms (274 m) and north of 52° 28' N latitude to provide an additional 26 stations with secondary priority for sampling during this survey. Finally, 49 stations with tertiary priority for sampling were established by extending the survey station grid with the same spacing of station centers into the 101–150 fathom (185–274 m) depth zone surrounding Petrel Bank and to areas outside of but

within 0.5 nmi (0.9 km) of the 150-fathom (274-m) contour line. This design resulted in a total of 193 station locations covering an area of approximately 1,105 nmi² (3,782 km²; Figure 3).

The 2009 survey commenced on November 6, ended December 5, and was conducted from aboard the chartered *F/V Arctic Fury*, a 44.2-m commercial crab-pot-fishing vessel. Of the 193 originally established stations and the 170 primary stations, 117 stations, covering an area of approximately 761 nmi² (2,732 km²), were fished during the survey (Figure 4). None of the secondary stations were fished during the survey. Strong winds at the commencement of the charter period delayed departure for Petrel Bank for two days. A medical condition of one ADF&G crew member and severe weather conditions period required two unplanned trips to Adak that together resulted in a loss of seven charter days during the survey. Weather throughout the survey charter was severe, hampering scheduled operations when on the survey grounds and resulted in an additional loss of two days. Locations of some stations had to be adjusted from the original design to avoid the Stellar sea lion no-entry zones, to stay within the depth zone targeted for the survey, and to adapt to restrictions set by currents or tides. Of the stations fished during the 2009 survey, all were within the boundaries of the November 2006 survey and 107 were within the boundaries of the November 2001 ADF&G-industry survey area.

Each station fished during the survey consisted of four pots arrayed approximately 0.125 nmi (0.23 km) apart in a north-south orientation. Each pot measured 7 ft x 7 ft x 2.8 ft (2.1 m x 2.1 m x 0.9 m), was fitted with 2.75-in (70-mm) stretch mesh on all webbing, and had two opposing tunnel openings measuring 8-in x 36-in (0.2-m x 0.9-m). Each pot was baited with two 2-qt (1.9-L) containers of chopped Pacific herring *Clupea pallasii* and one Pacific cod *Gadus macrocephalus* as hanging bait. Of the 468 pots deployed during the survey, 466 were successfully retrieved for catch sampling (one pot was lost at each of stations 8 and 134). The target soak time for each pot was 24–30 h, actual soak times during the survey ranged from 23.6 to 159.3 h and averaged 49.2 h. Depth of stations (i.e., the mean depth of the sampled pots within a station) fished during the survey ranged from 24 to 138 fathoms (44–252 m), with a mean of 75 fathoms (137 m) and 23 of the stations sampled were at depths of 101 to 138 fathoms (185–252 m).

Catch Sampling

Species composition was determined for each pot fished during the survey and all commercially important crab species were examined. The fork or total length was recorded for all commercially important fish species and all other fish and invertebrate species were enumerated. All red king crabs, golden king crabs, hair crabs *Erimacrus isenbeckii*, and Tanner crabs *Chionoecetes bairdi* captured during the survey were enumerated and sampled for sex, size, shell condition, and reproductive condition (for females only). Red king crabs, golden king crabs, and hair crabs were measured for carapace length (CL) to the nearest millimeter. Carapace length was measured from the posterior margin of the right eye socket to the midpoint of the rear margin of the carapace (Donaldson and Byersdorfer 2005). Each Tanner crab was measured for carapace width (CW) to the nearest millimeter. Carapace width was measured as the greatest straight line distance (excluding spines) across the carapace at a right angle to a line midway between the eyes to the midpoint of the posterior margin of the carapace (Jadamec et al. 1999). The fishery-legal status of male crabs was determined by the CW including spines relative to minimum legal size: ≥ 6.5 in (165 mm) for red king crab, ≥ 6.0 in (152 mm) for golden king crab, ≥ 3.25 in (83 mm) for hair crab, and ≥ 5.5 in (140 mm) for Tanner crab. The shell condition of each crab was recorded as new-shell pliable, new shell, old shell, or very-old shell according to the criteria provided in Donaldson and Byersdorfer (2005) for king and hair crabs and in

Jadamec et al. (1999) for Tanner crabs. The legal size for male red king crabs in the Petrel Bank fishery is the same as in the Bristol Bay red king crab fishery and the size at which 50% of females are mature (SM50) that has been estimated for Adak female red king crabs (89-mm CL; Blau 1990) is the same as that estimated for Bristol Bay female red king crabs (88.8-mm CL; Otto et al. 1990). Accordingly, the shell condition and size classes used to identify new recruits to legal size, mature-sized males, and pre-recruits to legal size for management of the Bristol Bay red king crab fishery (Vining and Zheng 2008) were used to summarize the data on size and shell condition of the male red king crabs captured in the Petrel Bank area during this survey:

new recruits to legal size – those new-shell legal males <150-mm CL,
mature-sized males – males \geq 120-mm CL, and
pre-recruits (one molt from legal size) – those sublegal males \geq 120-mm CL.

Females carrying a clutch of eggs were scored for clutch fullness (trace to $\frac{1}{8}$ full, $\frac{1}{4}$ full, $\frac{1}{2}$ full, $\frac{3}{4}$ full, and full), clutch condition (presence or absence of dead eggs), egg development (uneyed, eyed, or hatching), and color of eggs according to Donaldson and Byersdorfer (2005). Females without egg clutches were scored as either barren with clean pleopods or as barren with matted pleopods.

RESULTS

Red king crabs were captured at 24 of the 117 stations fished during the survey. Depths of those stations ranged from 54 to 127 fathoms (98–232 m), with a mean of 81 fathoms (148 m). Legal-sized male red king crabs were captured at all of those stations. Sublegal male red king crabs occurred at one station at a depth of 61 fathoms (112 m). Female red king crabs occurred at two stations, one at a depth of 54 fathoms (98 m), where 98% of the females were captured, and the other at a depth of 60 fathoms (110 m).

Twenty-six (22%) of all stations sampled had recorded depths of less than 54 fathoms (98 m; all located centrally on Petrel Bank or adjacent to Semisopochnoi Island) and no red king crabs were captured at any of those stations. Red king crabs were captured at 29% (20) of the 68 stations sampled at depths of 54 to 100 fathoms (98–183 m) and at 2% (4) of the remaining 23 stations sampled at depths of 101 to 138 fathoms (185–252 m).

A total of 763 red king crabs (703 males and 60 females) were captured during the survey (Table 1). Most of that catch was concentrated in only a few stations. Ninety-four percent (720) of the total red king crab catch occurred at 10 stations, 88% (668) at seven stations, and 59% (453) at just three stations. Similarly, 86% (583) of the 680 legal males were captured at only six stations and 50% (339) were captured at only two stations. Depths fished at the seven stations with the highest catches of red king crabs ranged from 54 to 73 fathoms (99–133 m), a similar depth range of the three stations with the highest catches of legal-size males (61 to 72 fathoms; 111–132 m).

The survey-wide catch per unit of effort (CPUE) of legal-sized male red king crabs was 1.5 crabs per pot lift, whereas the CPUE of sublegal male crabs was <0.1 crab per pot lift and that of female crabs was 0.1 crab per pot lift (Table 1). The highest single-station CPUE of legal males was 43.5 crabs per pot lift, of sublegal males was 5.7 crabs per pot lift, and of females was 14.7 crabs per pot lift. There were six stations (5% of the stations fished) where the CPUE for legal-sized red king crabs was 10 crabs per pot lift or greater, the minimum threshold CPUE at which fishery closure would occur (Bush et al. 2005). In addition to the afore mentioned CPUE of 43.5

crabs per pot lift, the CPUEs of legal males at the remaining five of those six stations were 41.3, 22.8, 15.3, 12.8 and 10.3 crabs per pot lift.

Males accounted for 92.1% of the total red king crab catch during the survey and ranged in size from 116-mm CL to 198-mm CL (mean = 166-mm CL, $n = 703$; Table 1). The size distribution of males displayed a unimodal distribution with a large, wide peak centered around 170-mm CL (Figure 5). Of the captured red king crab males, 96.7% (680) were of fishery-legal size. New recruits to legal size (47) accounted for 7.0% of the male red king crab catch and 7.2% of the catch of legal males. Over 99.8% (702) of the males were mature-sized. Of the 23 sublegal males captured, 95.7% (22) were pre-recruits estimated to be one molt from legal size, resulting in a prerecruit:legal ratio in the survey catch of 0.03:1. Although new-shell males were present in all size classes observed (42.1% of the catch), old-shell crabs represented 54.2% of all captured males.

Females accounted for 7.9% of the total red king crab catch during the survey and ranged in size from 100-mm CL to 177-mm CL (mean = 157-mm CL, $n = 60$; Table 1). The female size distribution displayed a bimodal distribution with the primary peak at 162-mm CL and another very small peak centered at 127-mm CL (Figure 6). Crabs classified as new-shell were dominant in all size categories and represented over 98% (59) of the captured females. All of the captured females were ≥ 89 -mm CL, the estimated SM50 for female red king crabs in the Adak area (Blau 1990), and all were mature, as evidenced by the presence of eggs or empty egg cases. Of those mature females, over 98% (59) carried eggs. The clutches in 25.1% (15) of the ovigerous females were scored as one-half full, 40.7% (24) were scored as three-quarters full and 30.5% (18) were scored as full.

DISCUSSION

Waters of the Petrel Bank area once produced as much as 15% of the seasonal catch of red king crabs between 171° W and 172° E longitude, and were the mainstay of the Adak registration area fishery in the early to mid 1990s prior to an area closure following the 1995/96 season (Bowers et al. 2002). After a few exploratory fisheries by one vessel, the Petrel Bank area was surveyed by the industry in 2001 which resulted in small fisheries during the 2002/03 and 2003/04 seasons. Declining catches during those fisheries prompted a fishery closure in 2004/05 and data collected by onboard observers during those fisheries indicated no recruitment to legal size would occur prior to the 2005/06 season. ADF&G systematically surveyed the Petrel Bank area in 2006 to provide information needed by fishery managers for their consideration of a reopening of the Petrel Bank red king crab fishery in the season to follow, the 2007/08 season. Of particular interest during that survey was the condition of the stock in November 2006 relative to its condition in November 2001, when legal males were at an abundance level capable of supporting limited commercial fisheries in the subsequent two seasons. Additionally, the spatial distribution of red king crabs in the 2006 survey area relative to that during the November 2001 ADF&G-industry survey and past Petrel Bank fisheries was of interest. Spatial distribution is an important consideration in the context of historical contraction in distribution of the Aleutian Islands red king crab fishery and provides additional information to survey CPUE for judging stock condition in November 2006 relative to November 2001 (for a detailed comparison of the 2006 ADF&G survey with the 2001 ADF&G-industry survey and recent commercial fisheries see Gish 2007).

The 2009 Petrel Bank red king crab survey was designed to encompass and expand upon the area surveyed by ADF&G in November 2006, the ADF&G-industry in November 2001, the areas

fished during the 2002/03 and 2003/04 Petrel Bank red king crab commercial fisheries, and the area producing 77% to 95% of the annual harvest of red king crab in the Adak Area during the 1990/91–1995/96 seasons. The survey was timed to occur at the same time of the year as the November 2006 ADF&G survey, the November 2001 ADF&G-industry survey and at, or close to, the same time of the year that the 1990/91–1995/96 Adak Area fisheries and the 2002/03 and 2003/04 Petrel Bank fisheries were prosecuted. Survey pots were fit with a small mesh size (2.75-in, or 70-mm, stretched) on all webbing to increase the retention of sublegal-sized red king crabs relative to the gear used during commercial fisheries or the surveys performed by industry in 2001. The density of survey stations within the 2009 survey area was high relative to other surveys for red king crabs in the Bering Sea/Aleutian Islands. The spacing between survey sampling stations used in the 2009 Petrel Bank survey was approximately 2.5 nmi (4.6 kms) as compared to a spacing of approximately 5.0 nmi (9.3 km) used in the ADF&G Pribilof Island king crab pot survey (Gish 2010) and a spacing of approximately 20 nmi (37.0 km) used to survey red king crab in Bristol Bay by the National Marine Fisheries Service (NMFS) during the eastern Bering Sea (EBS) trawl survey (Chilton et al. 2008). The area actually covered by the 2009 ADF&G Petrel Bank survey was sufficient to sample all stations where red king crabs were encountered during the 2006 ADF&G survey with the exception of the three stations on Petrel Spur where three legal-sized red king crabs were encountered. This discussion will be limited to comparison with the 2006 ADF&G survey.

Results of the 2009 Petrel Bank red king crab survey showed a distribution for red king crabs in the area that was limited to a relatively small portion of the bank and covered a smaller area than was observed for the same stations fished during the 2006 ADF&G survey. This limited distribution of red king crabs in the Petrel Bank area was evident in both surveys by catches occurring at only 21% (24 of 117) of the stations in 2009 and 22% (37 of 170) of the stations in 2006.

The 2009 catch of all red king crabs (763) was 70% of that caught during the 2006 survey (1,091) when comparing only the 117 stations in fished common (Table 1). In 2009, the legal-sized male catch was 85% of that caught in 2006, whereas the number of sublegal males was 15% and of females was 43% of that caught in 2006. The survey CPUE of legal-sized male red king crabs was 1.5 crabs per pot lift in 2009, while at those same stations in 2006 it was 1.7 crabs per pot lift. Also, the CPUE of sublegal males was <0.1 crab per pot lift in 2009 compared to 0.3 crab per pot lift in 2006 and females in 2009 were captured at a rate of 0.1 crab per pot lift compared to 0.3 crab per pot lift in 2006. The highest single-station CPUE for all red king crabs observed during the 2009 survey was 43.5 crabs per pot lift, whereas highest single-station CPUE for all red king crabs during the 2006 survey was 49.5 crabs per pot lift.

Although the number of red king crabs captured was low in both surveys, the results of the 2009 survey when compared to the 2006 survey provided evidence of an aging population with weak recruitment. The mean CL of males in 2009 was 166 mm compared to 151 mm observed in 2006. Likewise, the prominent mode in the survey size distribution for males shifted from centering on 152-mm CL in 2006 to 172-mm CL in 2009 (Figure 7). Only 0.1% (1 crab) of the males captured in 2009 was classified as immature on the basis of size, whereas 9.3% (88 crabs) of the males were classified as immature in 2006. Additionally, 97% of the males captured in the 2009 survey were of legal size as compared to 87% of those captured in 2006. The mean CL of females captured during the 2009 survey was 157 mm with the prominent mode centered around 162-mm CL, whereas the mean for females captured during 2006 was 126-mm CL with the prominent mode centered around 147-mm CL (Figure 8). No immature females were

captured during the 2009 survey, whereas 26% of the females captured during the 2006 survey were immature.

Overall, the results from the 2009 ADF&G Petrel Bank pot survey suggest a smaller, aging population of red king crabs with a more restricted distribution when compared to the results from the same stations fished during the 2006 ADF&G survey and provide no evidence for expecting recruitment to the stock in the near-term future.

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TABLES

Table 1.—Catch and carapace length statistics for red king crabs captured during the 2009 ADF&G Petrel Bank red king crab pot survey compared with those for the red king crabs captured during the 2006 ADF&G Petrel Bank red king crab pot survey at the 117 stations fished in common during both surveys.

| Red King Crab | 2009 | | 2006 | |
|--------------------|-------------|------|-------------|------|
| Catch | Number | CPUE | Number | CPUE |
| Legal Males | 680 | 1.46 | 801 | 1.72 |
| Sublegal Males | 23 | 0.05 | 151 | 0.32 |
| Females | 60 | 0.13 | 139 | 0.30 |
| Total | 763 | | 1,091 | |
| Carapace Length | Millimeters | | Millimeters | |
| Males: Maximum | 198 | | 200 | |
| Minimum | 116 | | 76 | |
| Mean | 166 | | 152 | |
| Total Male Crabs | 703 | | 952 | |
| Females: Maximum | 177 | | 157 | |
| Minimum | 100 | | 66 | |
| Mean | 157 | | 129 | |
| Total Female Crabs | 60 | | 139 | |

FIGURES

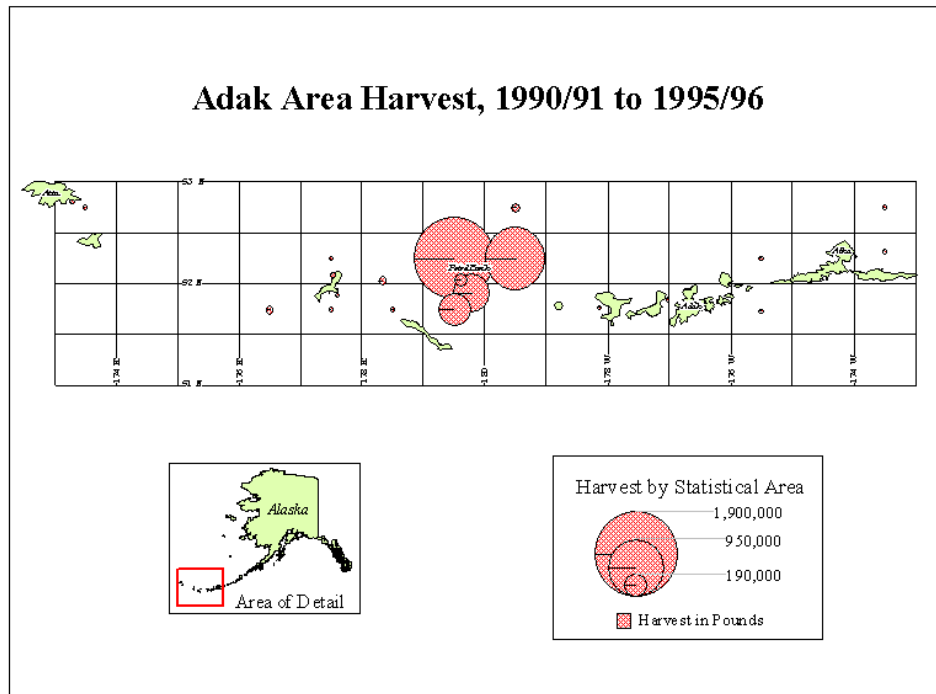


Figure 1.—Location and amount of red king crab harvest in the Adak area (Registration Area R), 1990/91 to 1995/96.

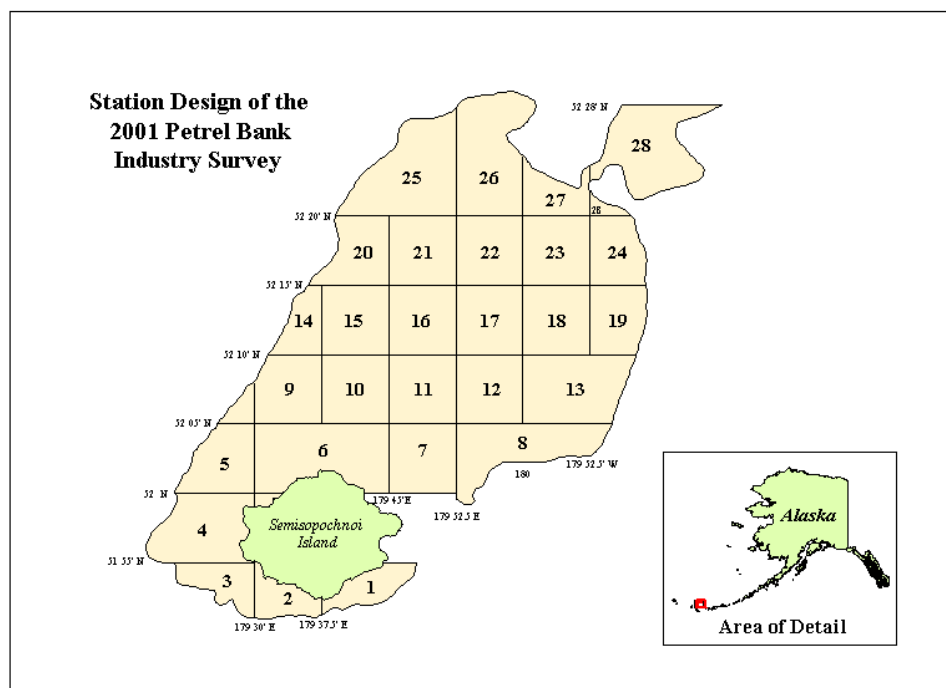


Figure 2.—Station design established for the 2001 ADF&G-industry survey of the Petrel Bank area.

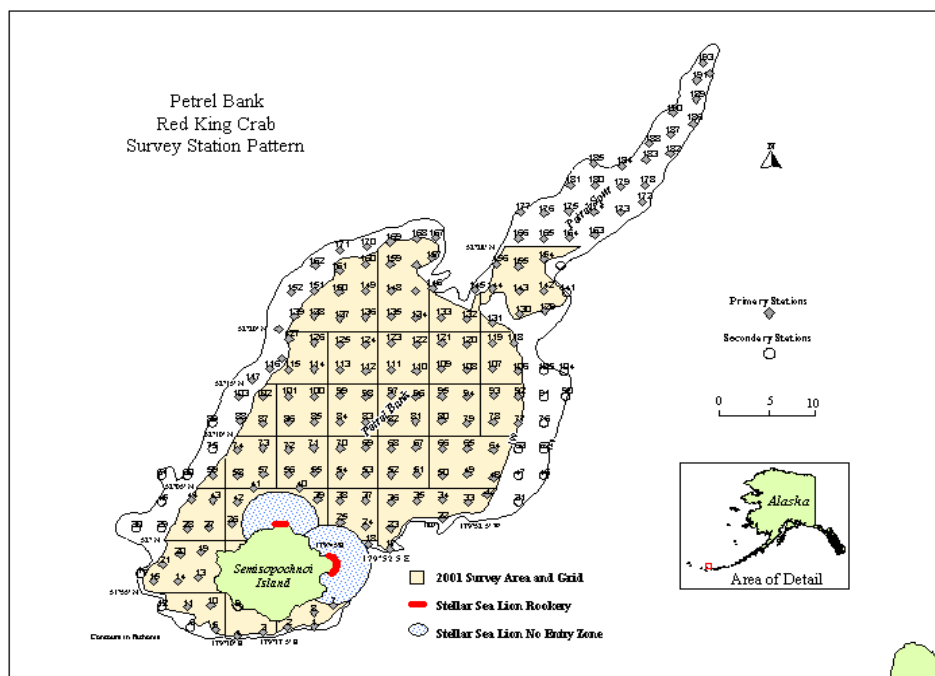


Figure 3.—Survey station pattern established for the 2009 ADF&G Petrel Bank red king crab pot survey.

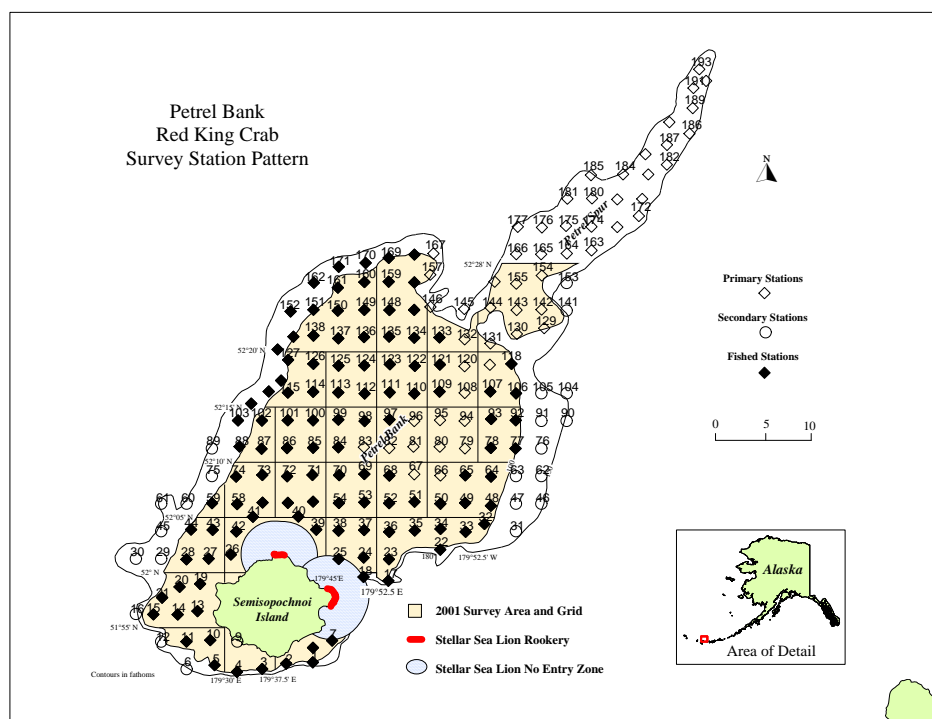


Figure 4.—Locations of fished stations during the 2009 Petrel Bank red king crab pot survey.

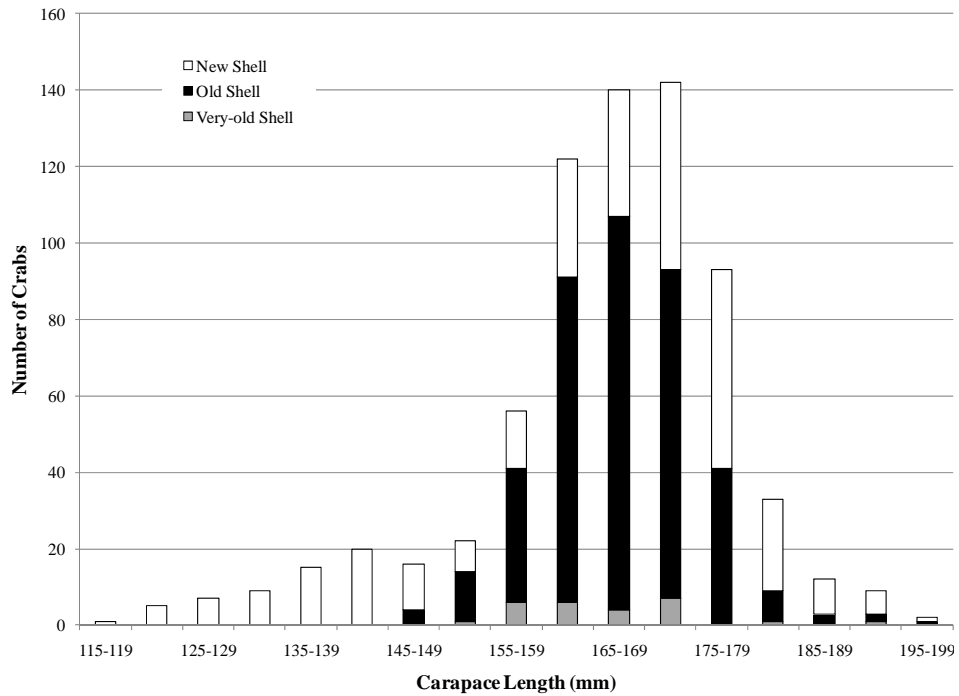


Figure 5.— Carapace length in 5-mm size classes of male red king crabs captured during the 2009 ADF&G Petrel Bank red king crab pot survey.

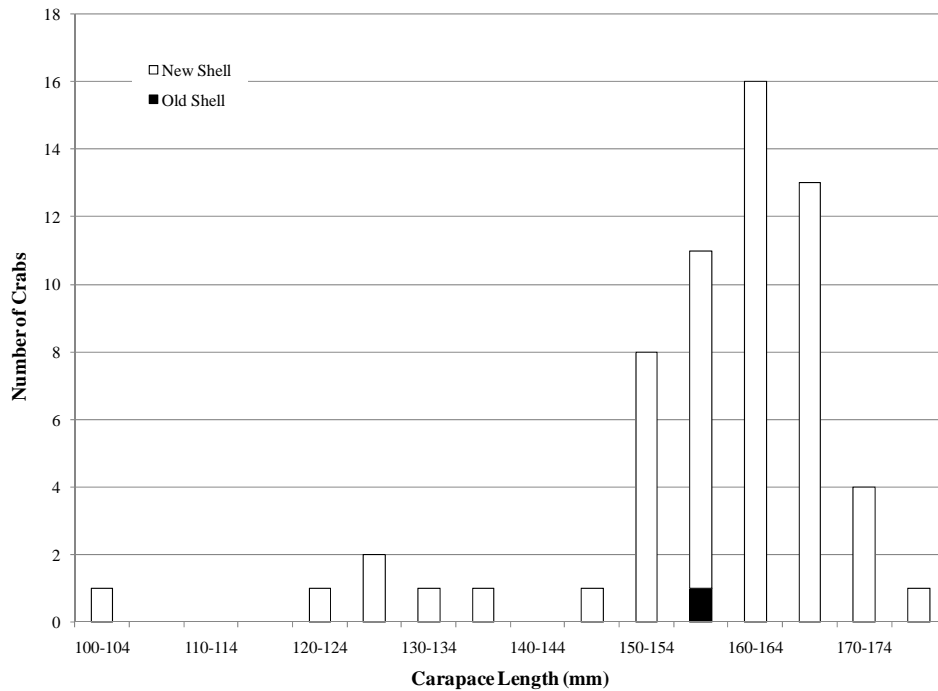


Figure 6.—Carapace length in 5-mm size classes of female red king crabs captured during the 2009 ADF&G Petrel Bank red king crab pot survey.

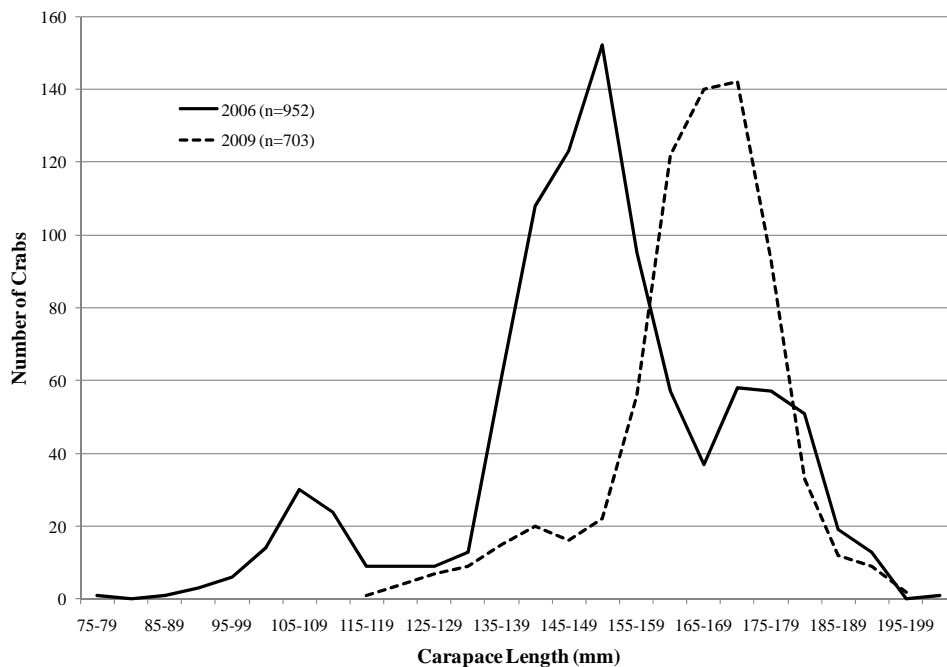


Figure 7.—Comparison of male carapace lengths observed during the 2009 and 2006 ADF&G Petrel Bank red king crab pot surveys.

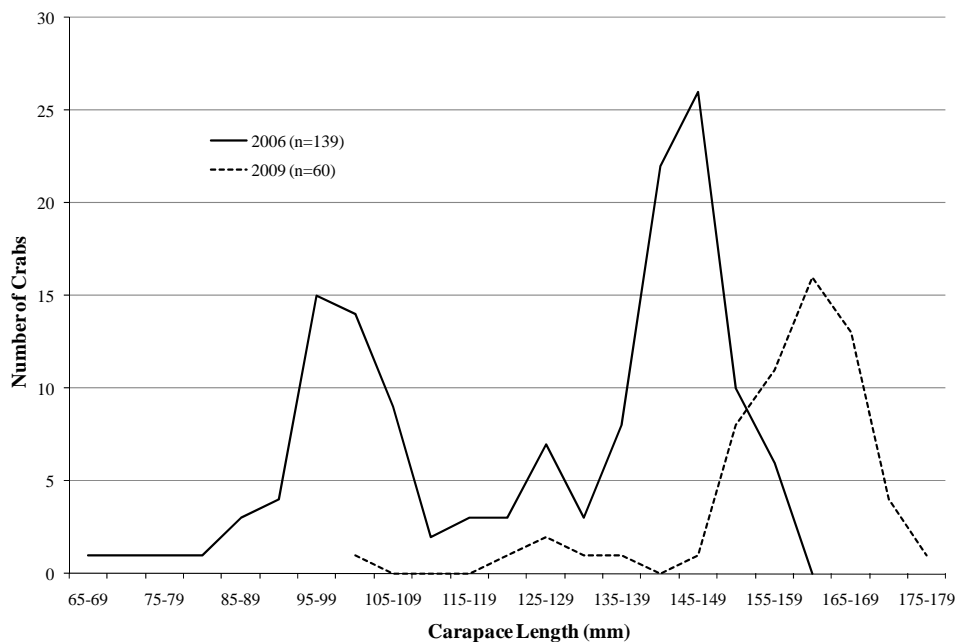


Figure 8.— Comparison of female carapace lengths observed during the 2009 and 2006 ADF&G Petrel Bank red king crab pot surveys.